(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 795 746 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.09.1997 Bulletin 1997/38

(51) Int. Cl.[6]: G01N 23/04, G01N 23/10

(21) Application number: 97102770.1

(22) Date of filing: 20.02.1997

(84) Designated Contracting States:
DE FR GB IT NL

(30) Priority: 15.03.1996 IT TO960203

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(54) Non-destructive X-ray inspection apparatus for food industry

(57) Inspection apparatus for glass vessels and/or cans for food industry,, composed of a static structure (11) comprising two modular units (13) mutually placed at 90° and placed at 45° with respect to the line for vessels (3); one unit (13) being equipped with a semi-panoramic emitter (15) and a sensor (7), the other unit (13) being equipped only with a sensor (7), equal to the sensor of the first unit (15). With said inspection structure with a single emitter (15) and two sensors (7) a 100% inspection is realized.

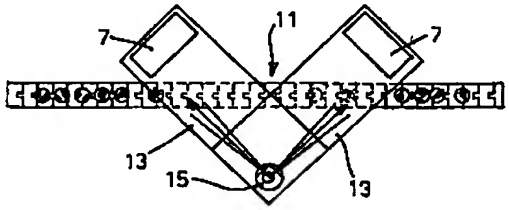

FIG. 4

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Description

The present invention deals with a non-destructive X-ray inspection apparatus for food industry, particularly for glass vessels and/or metal cans.

It is known that, in the vast majority of cases, non-destructive X-ray inspection for glass vessel in food industry is carried out by single devices, located on one side of the row of said vessels to be inspected; said devices being substantially equipped with an emitter and a sensor between which the row of said vessels to be inspected moves.

Similarly known is the fact that with such single devices a 90-95% inspection is obtained of the product contained therein, said deficiency being due to the shadow area projected by the concavity that is present, more or less importantly, in the vessel bottom.

To be more precise, refer to a glass vessel containing jam or a similar product; the impairing concavity is the one on the bottom of these vessels; this projection overlaps the contaminating agents hiding them and making their recognition impossible.

In many cases this result has been deemed, wrongly, enough, because an inspection valid only at 95% created a lot of problems, which it was attempted to solve through a few solutions, that proved however rather complicated and costly and not satisfactory enough.

Among the above solutions, mention can be made of a 45°-slant on the vertical emitter pipe plan, solution that only generated another shadow area in another point with respect to the traditional inspection apparatus placed on one side; moreover, though mitigating the darkening, it did not solve the problem, often due to high vessel tolerances. Furthermore, it cannot be applied to cans.

Another solution being studied in the United Kingdom provides two inspection apparata mutually placed at 90° on the vertical plan.

This latter solution seems to benefit from a partial reduction of shadow areas, but it uses two inspection apparata and the system overall dimensions are rather big; the cost for the two apparata, their maintenance and the like are important cost elements that cannot be overlooked.

Object of the present invention is solving the above-mentioned problem of removing the shadow area when inspecting packaged vessels, realizing an improved, simple and practical apparatus that allows easily obtaining the provided object of a complete inspection of sealed vessels.

The inspection apparatus of the present invention is composed of a static structure comprising two modular units mutually placed at 90° and placed at 45° with respect to a feeding line for vessels to be inspected; a first one of said two units being equipped with a semi-panoramic emitter and an X-ray linear sensor, a second one of said two units being equipped only with a sensor, equal to said sensor of said first unit; said inspection structure with a single emitter and two sensors realizing a structure able to inspect 100% of a product contained in said vessels.

The advantages of the apparatus of the invention are as follows:

- modularity: therefore, with the same performance a starting price (for the single module) is much less than the standard price, thus widening product markets;
- with two sensors a simultaneous failure thereof is statistically impossible, so that a user can go on working even in case one of the two sensors fails (inspecting 95% of the product);
- there are practically no installation problems with related costs;
- there are no costs for mechanical spare parts, being the structure substantially static with obvious maintenance advantages;
- there are no problems of space, thus complying with the food industry needs whose lines are almost always full and without spaces for apparata not provided for when designing.

Further features and advantages will appear from the following detailed description of an embodiment of the invention, with reference to the accompanying drawings, provided as a non limiting example, in which:

- Fig. 1 is a schematic plan view of a prior art inspection apparatus, placed at 90° with respect to the line of vessels to be inspected;
- Fig. 2 is a schematic plan view of a prior art inspection apparatus, placed at 45° with respect to the line of vessels;
- Fig. 3 is a schematic sectional view of the apparatus in Fig. 1;
- Fig. 4 is a schematic plan view of an inspection apparatus according to a first embodiment of the invention;
- Fig. 5 is a schematic plan view of an inspection apparatus according to a second embodiment of the invention;
- Fig. 6 is a section of a glass vessel with the typical bottom concavity.

As appears from Figures 1 and 3, prior art inspection apparata are composed of a structure 1 bridging a row on glass vessels 3 to be examined that move thereunder.

This structure includes a X-ray emitter 5 and a sensor 7, that collects rays emimtted by the emitter 5 and displays what has been inspected.

If a glass vessel is taken into account, it can be clearly seen how the concavity 9 provided on the bottom of said vessel 3 impairs a complete inspection of the product in the vessel; should this concavity or internal projection 9 be missing, obviously there would be no problems.

With the inspection apparatus of the invention shown in Fig. 4, instead, a static structure 11 is provided, composed of two modular units 13 placed at 90° one to the other and at 45° with respect to the feeding line of vessels 3 to be inspected.

One of these two units 13 is equipped with a semi-panoramic emitter 15 and with a normal sensor 7, while the other unit is equipped only with the sensor 7 equal to the one in the first unit.

In the embodiment of the inspection apparatus shown in Fig. 5, both units 13 are each equipped with a standard emitter 5 and a sensor 7.

It is clear that in this way shadow areas created by the concavity 9 of the vessels to be inspected, are removed, since the area not detected by a sensor will be detected by the other sensor at 90° with respect to the first one.

It is clear that, in case of failure of one of these sensors 7, a user can go on working, if he deems it adequate, with only one of them, always getting a 95% inspection as was the case in prior art.

Claims

1. Non-destructive X-ray inspection apparatus for glass vessels and/or cans for food industry, characterized in that it is composed of a static structure (11) comprising two modular units (13) mutually placed at 90° and placed at 45° with respect to a feeding line for vessels (3) to be inspected; a first one of said two units (13) being equipped with a semi-panoramic emitter (15) and a sensor (7), a second one of said two units (13) being equipped only with a sensor (7), equal to said sensor of said first unit (15); said static structure with a single emitter (15) and two sensors (7) realizing a structure able to inspect 100% of a product contained in said vessels.

2. Inspection apparatus according to claim 1, characterized in that each one of said two units (13) is equipped with an emitter (5) and a sensor (7).

3. Inspection apparatus according to claim 1 or 2, characterized in that it can be used as a normal unitary structure for a 95% inspection using a single one of said modular units (13) at 90° (or at 45°) with respect to the line of vessels (3) to be examined, using said emitter (15, 5) and only one sensor (7).

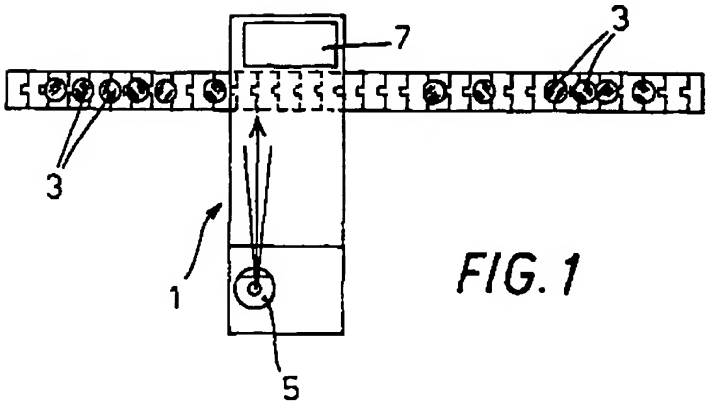

FIG. 1

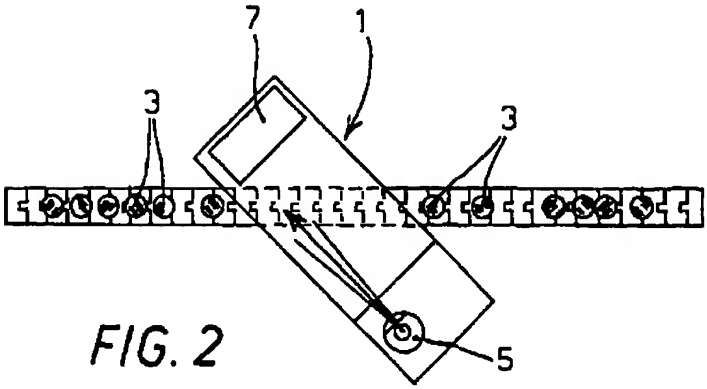

FIG. 2

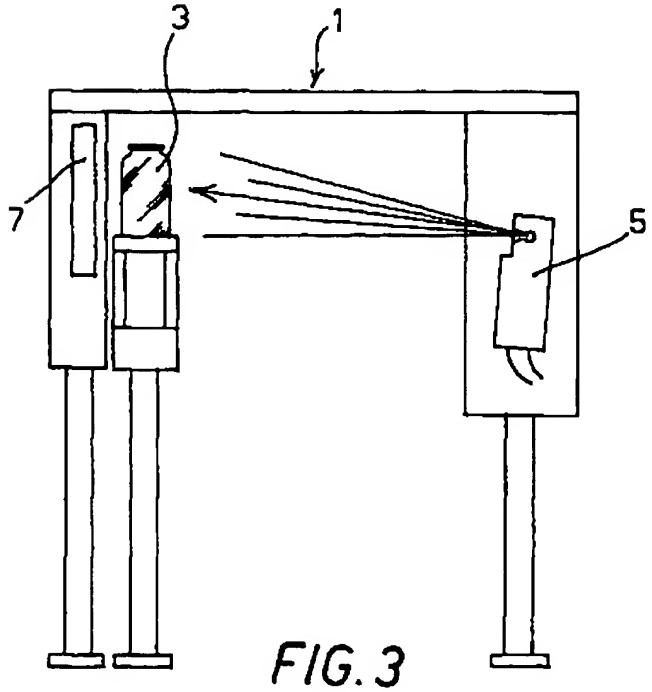

FIG. 3

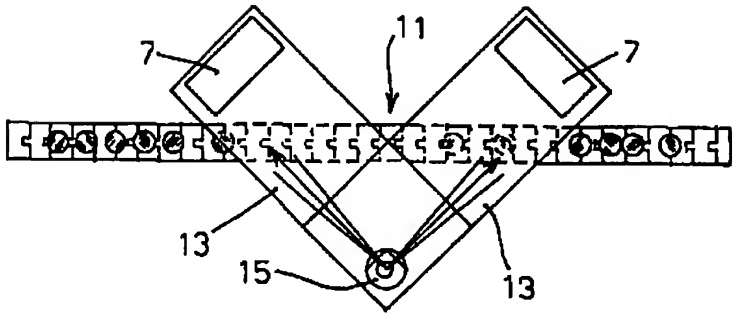

FIG. 4

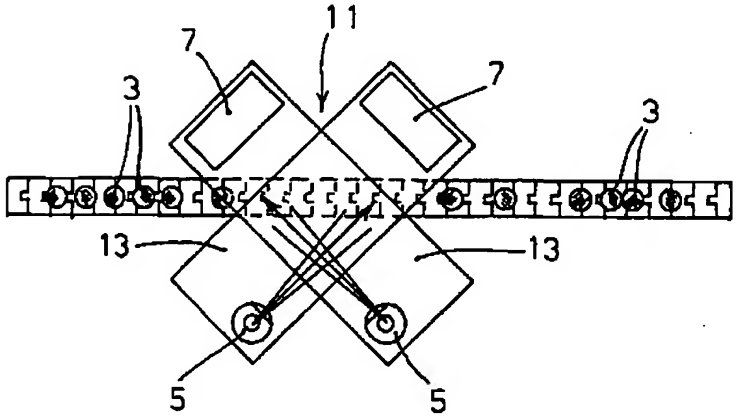

FIG. 5

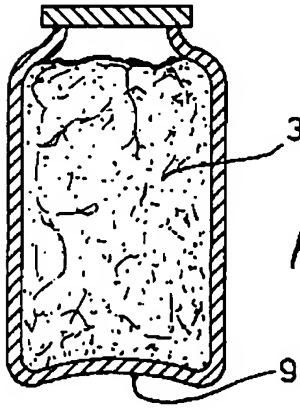

FIG. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 2770

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 442 672 A (BJORKHOLM PAUL J ET AL) 15 August 1995 * figure 5 *	2	G01N23/04 G01N23/10
X	DE 41 37 510 A (HEIMANN GMBH) 19 May 1993 * the whole document *	1	
X	US 3 958 078 A (FOWLER ROBERT Z ET AL) 18 May 1976 * column 28, line 12 - line 64; figure 17 *	2,3	
A	US 4 392 237 A (HOUSTON JOHN M) 5 July 1983 * the whole document *	1,2	
X	* column 5, line 23 - column 6, line 14 *	3	
A	EP 0 375 157 A (INTERTEST LTD) 27 June 1990 * the whole document *	1-3	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

G01N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	26 June 1997	Mueller, T

CATEGORY OF CITED DOCUMENTS

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